CLAIMS

1. A gas inlet manifold for a plasma chamber, comprising:

a top wall perforated by a gas inlet orifice;

a gas distribution plate perforated by a plurality of gas outlet orifices, wherein the gas distribution plate is spaced away from the top wall; and

a side wall including one or more segments, wherein each side wall segment includes a vertically oriented sheet extending between an upper flange and a lower flange;

wherein the upper flange of each side wall segment is mounted to the top wall of the gas inlet manifold;

wherein the lower flange of each side wall segment is mounted to the gas distribution plate; and

wherein the side wall encircles a region within the gas inlet manifold extending between the top wall and the gas distribution plate, so that the gas inlet orifice and the gas outlet orifices are in fluid communication with said region.

2. A gas inlet manifold according to claim 1, wherein:

the top wall of the gas inlet manifold has a surface facing the gas distribution plate that is generally rectangular with four sides;

the gas distribution plate has a surface facing the top wall that is generally rectangular with four sides;

the side wall comprises four of said segments; and

the sheet of each of the four side wall segments is generally rectangular and extends between a corresponding one of the four sides of said surface of the top wall and a corresponding one of the four sides of said surface of the gas distribution plate.

3. A gas inlet manifold according to claim 1, wherein:

the gas distribution plate has one or more grooves in its perimeter; and

the lower flange of each segment of the side wall extends into one of said grooves.

4. A gas inlet manifold according to claim 1, wherein:

the gas distribution plate further comprises

a lip extending radially outward from the perimeter of the gas distribution plate, and

a plurality of pins attached to, and extending downward from, the lip of the gas distribution plate;

the lower flange of each segment of the side wall is perforated by a plurality of holes;

each lower flange is mounted to the gas distribution plate so that each of said pins extends through a corresponding one of said holes; and

each hole is has a width that exceeds the width of its corresponding pin so as to permit relative movement between each lower flange and the gas distribution plate.

5. A gas inlet manifold according to claim 4, wherein:

each sheet is flexible so as to permit movement of the lower flange in a direction perpendicular to the sheet; and

for each segment of the side wall, each hole in the lower flange of that segment has a long axis parallel to the sheet of that segment.

6. A gas inlet manifold according to claim 4, wherein:

the width of each hole along one axis of the hole exceeds the width of its corresponding pin along said axis by an amount sufficient to permit an amount of relative movement between each lower flange and the gas distribution plate that exceeds the maximum likely relative differential thermal expansion between the lower flange and the gas distribution plate during operation of the plasma chamber.

7. A gas inlet manifold according to claim 4, wherein:

the width of each hole along one axis of the hole exceeds the width of its corresponding pin along said axis by at least 0.03 inch.

8. A gas inlet manifold according to claim 4, wherein:

the width of each hole along one axis of the hole exceeds the width of its corresponding pin along said axis by at least 0.1% of the widest dimension of the gas distribution plate.

9. A gas inlet manifold according to claim 1, wherein:

said one or more side wall segments include first and second side wall segments;

the sheet of the first side wall segment and the sheet of the second side wall segment are separated by a gap, wherein the gap has its longest dimension extending vertically between the top wall of the gas inlet manifold and the gas distribution plate; and

the gas inlet manifold further comprises a post mounted radially outward of the gap and positioned sufficiently close to the gap to impede the flow of gas through the gap.

10. A gas inlet manifold according to claim 1, wherein:

said one or more side wall segments include first and second side wall segments;

the sheet of the first side wall segment is bent at a first angle along a first vertical vertex line so that: (i) a first end area of the sheet extends between the first vertex line and an edge of the sheet, and (ii) a first central area of the sheet lies on the opposite side of the first vertex line;

the sheet of the second side wall segment is bent at a second angle along a second vertical vertex line so that: (i) a second end area of the sheet extends between the second vertex line and an edge of the sheet, and (ii) a second central area of the sheet lies on the opposite side of the second vertex line;

said edge of the sheet of the first side wall segment and said edge of the sheet of the second side wall segment are positioned so as to be parallel and separated by a gap, wherein the gap has a longest dimension extending vertically between the top wall of the gas inlet manifold and the gas distribution plate; and

the first and second angles are such that the first and second end areas are coplanar and are separated only by said gap.

11. A gas inlet manifold according to claim 10, wherein both the first angle and the second angle are 45 degrees.

12. A gas inlet manifold according to claim 10, further comprising a post mounted radially outward of the gap, wherein:

the post extends vertically along the entire length of the gap;

the post extends laterally so as to overlie the first end area, the second end area, a portion of the first central area adjoining the first vertex line, and a portion of the second central area adjoining the second vertex line; and

the post is positioned sufficiently close to said portions of the first and second areas, and said portions of the first and second areas are sufficiently large, so that the post impedes gas within the inlet manifold from flowing through the gap.

13. A plasma chamber comprising:

a chamber wall;

an inlet manifold top wall attached to the chamber wall, wherein the inlet manifold is perforated by a gas inlet orifice;

a gas distribution plate perforated by a plurality of gas outlet orifices, wherein the gas distribution plate is positioned within the plasma chamber and spaced away from the inlet manifold top wall; and

an inlet manifold side wall including one or more segments, wherein each side wall segment includes a vertically oriented sheet extending between an upper flange and a lower flange;

wherein the upper flange of each side wall segment is mounted to the top wall of the inlet manifold;

wherein the lower flange of each side wall segment is mounted to the gas distribution plate;

wherein the side wall encircles a region within the gas inlet manifold extending between the top wall and the gas distribution plate, so that the gas inlet orifice and the gas outlet orifices are in fluid communication with said region; and

wherein the inlet manifold side wall interposes a sufficiently high thermal resistance between

the chamber wall and the gas distribution plate so that, during operation of the plasma chamber, the gas distribution plate has a spatial variation in temperature no greater than 50 degrees C.

14. A plasma chamber according to claim 13, wherein said spatial variation in temperature is no greater than 10 degrees C.

15. A plasma chamber for processing a substrate, comprising:

a heated pedestal having an upper surface on which a substrate can be supported;

a chamber wall;

an inlet manifold top wall attached to the chamber wall, wherein the inlet manifold is perforated by a gas inlet orifice;

a gas distribution plate perforated by a plurality of gas outlet orifices, wherein the gas distribution plate is positioned within the plasma chamber and spaced away from the inlet manifold top wall; and

an inlet manifold side wall including one or more segments, wherein each side wall segment includes a vertically oriented sheet extending between an upper flange and a lower flange;

wherein the upper flange of each side wall segment is mounted to the top wall of the inlet manifold;

wherein the lower flange of each side wall segment is mounted to the gas distribution plate;

wherein the side wall encircles a region within the gas inlet manifold extending between the top wall and the gas distribution plate, so that the gas inlet orifice and the gas outlet orifices are in fluid communication with said region; and

wherein the inlet manifold side wall interposes a sufficiently high thermal resistance between the chamber wall and the gas distribution plate so that, during operation of the plasma chamber with said substrate being supported on the pedestal, there is a temperature difference between the pedestal and the upper surface of the substrate no greater than 50 degrees C.

16. A plasma chamber according to claim 15, wherein said temperature difference is no greater than 25 degrees C.

17. A method of minimizing thermal stress on a gas distribution plate through which gas is dispensed into the interior of a plasma chamber, comprising the steps of:

providing a plasma chamber having an interior encircled by a chamber wall;

mounting an inlet manifold top wall within the chamber;

providing an inlet manifold side wall having one or more segments, wherein each side wall segment includes a vertically oriented sheet extending between an upper flange and a lower flange;

mounting the upper flange of each segment of the inlet manifold side wall to the inlet manifold top wall so as to position the segments of the inlet manifold side wall so that they collectively encircle an inlet manifold region within the plasma chamber;

mounting the lower flange of the inlet manifold side wall to a gas distribution plate perforated by a plurality of gas outlet orifices, wherein the inlet manifold top wall, the inlet manifold side wall, and the gas distribution plate collectively enclose said inlet manifold region; and

supplying a gas through an aperture in the inlet manifold back wall so that the gas flows into the inlet manifold region and then flows through the gas outlet orifices into the interior of the plasma chamber.

18. A method according to claim 17, further comprising the step of:

maintaining a plasma within the interior of the plasma chamber;

wherein the step of providing the inlet manifold side wall includes the step of providing each sheet with a thickness sufficiently small, and an axial height sufficiently large, so as to produce a substantial temperature differential between the inlet manifold back wall and the gas distribution plate in response to the heat transferred from the plasma.

19. A method according to claim 18, wherein said temperature differential is at least 100 degrees C.

20. A method according to claim 17, wherein the step of providing the inlet manifold side wall includes the step of:

providing the at least one flexible portion of the inlet manifold side wall with a flexibility sufficient so that no substantial force is required to bend the inlet manifold side wall by an amount

sufficient to permit the gas distribution plate to expand by at least one percent.